"On the Comparative Efficiency as Condensation Nuclei of positively and negatively charged Ions." By C. T. R. WILSON, M.A. Communicated by the Meteorological Council. Received May 11,—Read June 15, 1899.

(Abstract.)

The experiments described in this paper were undertaken with the object of throwing some light upon what appeared to be fundamental questions in connection with the electrical effects of precipitation. It was hoped in this way to make some advance towards an understanding of the relation between rain and atmospheric electricity.

It was pointed out by Professor J. J. Thomson* that if positive and negative ions differed in their power of condensing water around them, drops might be formed upon one set of ions only, and separation of positive and negative electricity would then take place by the falling of the drops, the work required for the production of the electric field being due to gravity.

To make this process worthy of consideration as a possible source of atmospheric electricity, it would be necessary to show reason for believing (1) that atmospheric air in the regions in which rain is formed is likely to contain free ions, (2) that positively and negatively charged ions differ in their efficiency as condensation nuclei.

It is mainly with the second of these questions that this paper deals. The result of this part of the investigation was to prove that water condenses much more readily on negative than on positive ions. The experiments consisted in measurements of the expansion required to cause condensation in the form of drops in air initially saturated and containing ions, alternately nearly all positive and nearly all negative. The ratio of the final to the initial volume being indicated by v_2/v_1, then, to cause water to condense on negatively charged ions, the supersaturation must reach the limit corresponding to the expansion $v_2/v_1 = 1{\cdot}25$ (approximately a fourfold supersaturation). To make water condense on positively charged ions, the supersaturation must reach the much higher limit, corresponding to the expansion $v_2/v_1 = 1{\cdot}31$ (the supersaturation being then nearly sixfold).

We see, then, that if ions ever act as condensation nuclei in the atmosphere, it must be mainly or solely the negative ones which do so, and thus a preponderance of negative electricity will be carried down by precipitation to the earth's surface.

Incidentally it was proved that the difference between the effects as condensation nuclei of the positively and negatively charged ions is not to be explained by supposing that the charge carried by the nega-

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tive ions is, say, twice as great as that carried by the positive ions, for equal numbers of positive and negative ions are produced by the ionisation of the neutral gas.

Attempts were now made to find an answer to the first question suggested above—Is there any evidence that ions are likely to be present under normal conditions in the atmosphere?

Former experiments furnished a certain amount of evidence in favour of an affirmative answer.

When moist dust-free air is allowed to expand suddenly a rain-like condensation always take place if the maximum supersaturation exceeds a certain limit. This limit is identical with that required to make water condense on ions; the identity is in fact so exact as to furnish what is at first sight almost convincing evidence that ordinary moist air is always to a very slight extent ionised. The number of these nuclei is too small to make the absence of sensible electrical conductivity in air under ordinary conditions inconsistent with the view that they are ions.

All attempts, however, to remove these nuclei, by applying a strong electric field such as would have removed ordinary ions almost as fast as they were produced, have failed, even when a differential apparatus was used, such as would have made manifest even a slight diminution in the number of the nuclei by the action of the field. The same is true of the similar nuclei produced by the action of weak ultra-violet light on moist air.

Such nuclei, therefore, in spite of their identity as condensation nuclei with the ions, cannot be regarded as free ions, unless we suppose the ionisation to be developed by the process of producing the supersaturation. This question requires further investigation.

"Data for the Problem of Evolution in Man. II. A First Study of the Inheritance of Longevity and the Selective Death-rate in Man."

By Miss Mary Beeton and Karl Pearson, F.R.S., University College, London. Received May 29,—Read June 15, 1899.

According to Wallace and Weismann* the duration of life in any organism is determined by natural selection. An organism lives so long as it is advantageous, not to itself, but to its species, that it should live. But it would be impossible for natural selection to determine the fit duration of life, as it would be impossible for it to fix any other character, unless that character were inherited. Accordingly the hypothesis above referred to supposes that duration of life is an

* See Weismann, 'On Heredity,' Essays I and II, and especially Professor Poulton's note as to Wallace, p. 23, of first English edition.